549

PHYSICS ABSTRACTS

BEING

SCIENCE ABSTRACTS—SECTION A

EDITED AND ISSUED MONTHLY BY
THE INSTITUTION OF ELECTRICAL ENGINEERS
IN ASSOCIATION WITH
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THE AMERICAN PHYSICAL SOCIETY
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ABSTRACTS 2102–2279

Vol. 46 SEPTEMBER, 1943 No. 549

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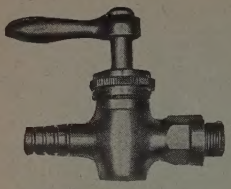

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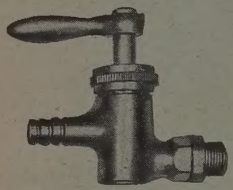

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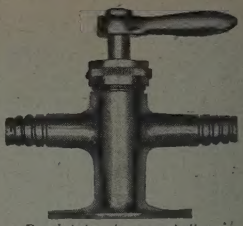

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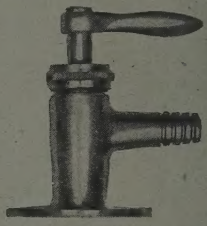

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MATHEMATICS

See Abstr. 2172 512.972 : 535.338.42

2102 513.73 : 621.316.35

Formulae for the geometric mean distances of rectangular areas and of line segments. HIGGINS, T. J. *J. Appl. Phys.*, 14, *pp.* 188–195, *April*, 1943.—[Abstr. 1843 B (1943)].

See Abstr. 2141 513:735.92 : 530.12

2103 513.835

New characterizations of segments and arcs. BLUMENTHAL, L. M. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 107–109, *March–April*, 1943.

2104 515.6 : 778.3

Perspective drawing made easy by photography. WHEELER, L. J. *J. Sci. Instrum.*, 20, *pp.* 115–116, *July*, 1943.

See Abstr. 2163 517.432.1 : 621.3.015.3 : 534.01

See Abstr. 2105 517.61 : 517.942.6

2105 517.942.6 : 517.61

Proofs of some formulae for the hypergeometric function and the E-function. MACROBERT, T. M. *Phil. Mag.*, 34, *pp.* 422–426, *June*, 1943.

2106 517.944 : 531.258

A stress function for the membrane theory of shells of revolution. NEMENYI, P., AND TRUESDELL, C. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 159–162, *May*, 1943.—A simple method of exact solution of the membrane equations for any surface of revolution and for any load representable by a Fourier polynomial is given.

2107 517.946.6

Linear partial differential equations with analytic coefficients. JOHN, F. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 98–104, *March–April*, 1943.—Contains some general results on linear partial differential equations with analytic coefficients; in particular it is concerned with questions of uniqueness of solutions of the Cauchy problem, and with the functional character of the solutions.

2108 518.3/.4

Standard curves. HANSEL, C. W. *Phil. Mag.*, 34, *pp.* 361–376, *June*, 1943.—A method is proposed, using one std. curve to represent all functions of the same type, and adjusting the scales until this curve represents the cartesian plot of any selected function of that type. The curve $Y = X^2$ may be used as a std. to represent any quadratic function $y = ax^2 + bx + c$. Using the std. curves $Y = X^3 - 3X^2$, $Y = \sin X$, and $Y = e^X$, $Y = e^{-X^2}$, any cubic, sine or exponential function may be represented without transformation of origin.

2109 519.21 : 521 : 53

Stochastic problems in physics and astronomy. CHANDRASEKHAR, S. *Rev. Mod. Phys.*, 15, *pp.* 2–89, *Jan.*, 1943.—The author reviews certain fundamental probability methods in which a property is considered which is the result of superposition of a large number of variables whose values are governed by certain probability laws. Special attention is paid to the problem of random flights, to the theory of the Brownian motion of free and bound particles, to colloid statistics and the escape over potential barriers, and to the statistics of the gravitational field arising from a random distribution of stars. A number of appendices give certain theorems in pure probability theory. A. HU.

2110 519.272

On the distribution of random distances in a rectangle. GHOSH, B. *Sci. and Cult.*, 8, *p.* 388, *March*, 1943.

2111 519.41

Groups containing a prime number of conjugate subgroups. MILLER, G. A. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 104–107, *March–April*, 1943.

2112 519.44

Relations between homology and homotopy groups. EILENBERG, S., AND MACLANE, S. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 155–158, *May*, 1943.

2113 519.48

On some artificial fields and their correlation functions. GHOSH, B. *Sci. and Cult.*, 8, *pp.* 424–425, *April*, 1943.

ASTRONOMY. GEODESY

See Abstr. 2109 521 : 53 : 519.21

2114 521.036 : 550

The physical chemistry of a cooling planet. NUTTING, P. G. *J. Wash. Acad. Sci.*, 33, *pp.* 121–125, *May* 15, 1943.—The author sketches the early physical history of the Earth on a temperature scale based on known data of physical chemistry and on the chemical composition of its surface. The subdivisions inferred are great natural epochs: the gas and vapour phase, the first liquid core, the first solids, the silicate crust, the carbonates, the first surface water, and finally the formation of hydroxides and hydrocarbons. The conclusions accord well with known geological facts. A. HU.

2115 523.1

The structure of the universe. JEANS, J. *Nature, Lond.*, 151, *pp.* 490–492, *May* 1, 1943. *Paper read before the Roy. Instn.*—Observational evidence on the structure of the universe and on its apparent expansion is related to the relativity picture and to Eddington's and Milne's theories. If the numerical coincidences betw. the values of certain fundamental physical entities are regarded as significant, and all observed numbers of the order of 10^{39} owe their approx. equality to something in the fixed order of Nature, it is shown that the physical "constants" vary with time, and that the mechanical interpretation of the universe fails. A. HU.

2116 523.741

On the presence of phosphorus in the solar atmosphere. RAO, K. N. *Sci. and Cult.*, 8, *pp.* 423–424, *April*, 1943.

2117 523.755

Temperature of the solar corona. VAND, V. *Nature, Lond.*, 151, *p.* 728, *June* 26, 1943.

2118 523.77

Line-width measures and the observation of a red shift in the eruptive Hα line. ELLISON, M. A. *Mon. Not. Roy. Astr. Soc.*, 103, 1, *pp.* 3–9, 1943.—The

evidence is reviewed for the existence of vertical and horizontal movements in the bright Hα emission of chromospheric eruptions. 187 measures of line width, made upon 22 eruptions, show a red shift increasing with line width and visual intensity. The measures were made upon the wings of the emission line and are rel. to the centre of the Hα absorption line for the surrounding field. The data do not favour a Doppler interpretation. The observed red shift arises from increased absorption on the violet side of the emission line, which may have its origin in the expulsion at high vel. of absorbing matter from the eruption as centre. Line-width measures are plotted, as a function of time, during the progress of 10 eruptions. These curves indicate a rapid rise to max. brightness and line width followed by a slow decline. The question of horizontal movements in the bright emission is discussed, and it is concluded that, while the displacement caused by a steady vel. of 1 km./sec. could be easily measured, no such movements have been certainly observed.

See Abstr. 2171 523.77 : 535.338.3

2119 523.774

Profiles in the alpha band of atmospheric oxygen. PANOFSKY, H. A. A. *Astrophys. J.*, 97, *pp.* 180–185, *March*, 1943.—Seven lines in the α-band of atmospheric O_2 in the sun's spectrum were photographed with the Berkeley solar spectrograph and interferometer, and their profiles were measured. The consistency of the results with one another and with theory indicates that there are no serious errors in the measurement of profiles by the interferometric method after instrumental effects have been eliminated. The total absorption coeff. of the α-band was computed. The mean mol. dia. for collisions between O_2 molecules and air molecules was estimated to be $5{\cdot}15 \times 10^{-8}$ cm.

2120 523.832

The variable proper motion of the star Cincinnati 1244. REUYL, D. *Astrophys. J.*, 97, *pp.* 186–189, *March*, 1943.—Photographic observations indicate the presence of a second body. The material consists of 109 plates. An analysis of the perturbations in r.a. and decl. with a period of 26·5 years, gives 0·54 astronomical units for the semimajor axis of the orbit about the centre of mass. The mass of the dark companion amounts to 0·03 ⊙.

2121 523.832

The radial velocities of faint class B stars in the declination zone 0° to − 23°. NEUBAUER, F. J. *Astrophys. J.*, 97, *pp.* 300–310, *May*, 1943.—The radial velocities of 433 stars of spectral classes Oe5–B5 were determined at the Lick Observatory. For 397 faint stars of the present list no previous determinations of radial velocity have been published. The spectra are classified on the Victoria system.

2122 523.832

The radial velocity of 27 Canis Majoris. STRUVE, O. *Astrophys. J.*, 97, *p.* 453, *May*, 1943.

2123 523.84

Notes on proper-motion stars. V. KUIPER, G. P. *Astrophys. J.*, 97, *pp.* 275–276, *March*, 1943.—[See Abstr. 554 (1943)]. Two new white dwarfs, as well as 6 new binaries with large proper motion, are announced; for 3 known binaries large parallaxes are found.

2124 523.841.1

HD 15963, a new shell star. BIDELMAN, W. P. *Astrophys. J.*, 97, *p.* 452, *May*, 1943.

2125 523.841.1.035.921.1

Visual light-curve of Nova Puppis. KUIPER, G. P. *Astrophys. J.*, 97, *pp.* 443–444, *May*, 1943.

2126 523.841.11 : 523.872

On the spectra of novae. MCLAUGHLIN, D. B. *Publ. Obs. Univ. Mich.*, 8, 12, *pp.* 149–194, 1942.—A generalized picture of the spectroscopic development of a typical nova is drawn from a survey of 7 bright novae. Five systems of absorption lines and 7 of emission lines are distinguished, many of them existing concurrently. Fluctuations in the light-curve are correlated with spectral changes and with velocity changes. The phenomena are attributed to a continuous emission of stellar material from a thin superficial layer at a variable rate which reaches a max. just before light max. The velocity of the ejected matter is not related to this rate and reaches its max. long afterwards. The source of the energy involved is not identified. A. HU.

See Abstr. 2137 523.841.332 : 523.876

2127 523.842.3

Five spectroscopic binaries. POPPER, D. M. *Astrophys. J.*, 97, *pp.* 394–411, *May*, 1943.—SX Aurigae.—Spectroscopic observations yield $K_1 = 172$, $K_2 = 322$ km./sec., and the photographic luminosity ratio of the 2 components, $l_2/l_1 = 0{\cdot}45$. These results are combined with Oosterhoff's accurate light-curve to obtain values of the masses, radii and luminosities and estimates of their uncertainties. V Puppis.—$K_1 = 199$, $K_2 = 342$ km./sec., and $l_2/l_1 = 0{\cdot}57$. New values of the masses, radii and luminosities of the components are adopted. ζ Centauri.—K_1(111 km./sec.) + K_2(159 km./sec.) is < Maury's determination. An improved value of the period is obtained. RY Scuti.—With the exceptions of λ4 026 and λ4 088, all strong lines show stationary displacements and originate in a shell. If the variations of the positions of these lines represent orbital motion, the mass of the system is > 100 ⊙. i Bootis B.—$K_1 = 115$, $K_2 = 231$ km./sec., and $l_2/l_1 \simeq 0{\cdot}6$. A period 15×10^{-7} days longer than that obtained by Plaut from the photometric data is required to satisfy the spectroscopic observations.

2128 523.842.3.035.92

A photo-electric light-curve for the Wolf-Rayet eclipsing binary HD 193576. KRON, G. E., AND GORDON, K. C. *Astrophys. J.*, 97, *pp.* 311–322, *May*, 1943.—The observations confirm the period, 4^d21238, derived by Wilson from a variation in radial velocity but show a discrepancy of -0^d022 between his epoch of conjunction and the epoch of primary min. The depth of primary min. is 0^m297 and that of secondary min. 0^m141. Betw. eclipses the light appears to be const. The width of primary min. is 2 × width of secondary min. Secondary min. is displaced -0^d011 from the midpoint.

2129 523.854.22

The Milky Way in Cepheus. RISLEY, A. M. *Astrophys. J.*, 97, *pp.* 277–299, *May*, 1943.—Data are given on the surface distribution of stars to the 15th magnitude over 750 sq. degs. No part of the field is unobscured: the absorption varies from 0·5 to

·5 mag./kpc. Solutions for the density function are made assuming a coeff. of absorption const. in any one direction. N of the galactic plane the density is const. out to several hundred pc., after which it drops sharply. S of the plane the density rises in the first 500 pc. Several regions near the galactic equator are relatively clear and would repay investigation.

A. HU.

2130 523.854.22

The theory of Cepheid variables and novae. HOYLE, F., AND LYTTLETON, R. A. *Mon. Not. Roy. Astr. Soc.*, 103, 1, *pp.* 21–37, 1943.—The authors consider a binary system in which a common atmosphere surrounds both components [Abstr. 524 (1941)]. Most of the mass of either component is confined to a volume small compared with that of the whole system, and the material of the atmosphere does not take part in the orbital motion of the components. The amplitude of the oscillation of regions lying in the orbital plane is discussed and velocity/time curves are deduced for the motion of the free surface. Variations in surface temperature and apparent luminosity accompanying the dynamical oscillations of the atmosphere are shown to be similar to those of observed Cepheids. A possible explanation of the occurrence of novae arises naturally as a further stage in the evolution of these stars.

A. HU.

2131 523.854.22

A photographic survey of galactic clusters. IV. N.G.C. 6596, 6603, 6605, 6613, 6618, 6645, 6647, I.C. 4725, Tr. 33, Cr. 371, 469. ALTER, G. *Mon. Not. Roy. Astr. Soc.*, 103, 1, *pp.* 10–20, 1943.—The region of this group lies near the Small Sagittarius Cloud. Of the 11 star groups recorded in different catalogues as clusters, 5 were considered not to be true clusters. The CI of some measured clusters agreed with the spectral types of their members; this seems inconsistent with the fact that the clusters lie within a region where selective absorption has been found and some CE might be expected. Two explanations of this apparent contradiction are suggested. N.G.C. 6645 and Tr. 33 contain giants. The former contains a secondary condensation of 10 stars, the spatial density of which is larger than in any known galactic cluster. In the region of I.C. 4725 are 2 very red stars that may be situated in the neighbourhood of the Sun and one of which may be a variable.

2132 523.872

Measurements in the spectrum of τ Scorpii. MERRILL, P. W., AND ADAMS, W. S. *Astrophys. J.*, 97, *pp.* 98–104, *March*, 1943.—Three Coudé spectrograms, dispersion 2·9 Å/mm., provide the basis for a brief study of the widths and displacements of lines of H, He, O, Ne and other elements. With a few exceptions, lines of various elements yield accordant values of the radial velocity. The profiles and displacements of the He lines offer strong evidence of the Stark effect.

2133 523.872

Spectrographic observations of peculiar stars. V. SWINGS, P., AND STRUVE, O. *Astrophys. J.*, 97, *pp.* 194–225, *March*, 1943.—[See Abstr. 565 (1943)]. Z Andromedae displayed strong [Fe VII] lines in July and Nov., 1942. A table is given, describing the spectrum of this star in 3 successive years. Attention is called to several bright lines recently found in CI Cygni. A description is given of the line emission in RS Ophiuchi. New data on the emission lines of Fe I, Fe II, [Fe II], [Fe III], and [Fe V] in peculiar stars are provided. Four stars with absorption shells are described in detail. Descriptions of the spectra of 83 Be stars from the catalogue of Merrill and Burwell are given. Attention is called especially to MWC 23, which has a strong shell spectrum of H, and to MWC 342, which has strong emission lines of H, Fe II, [Fe II], and shows structure in the lines of H. The fluorescence and recombination mechanisms of line emission in shells are related to the general characteristics of the shell spectra. Emphasis is placed on the effects of ejection, axial rotation and turbulence. The spectacular "nitrogen flaring stages" of novae are discussed, and the associated spectroscopic phenomena are interpreted.

2134 523.872

The shell spectrum of HR 8731 in 1940, with an inter-comparison of the spectra of several shells. BALDWIN, R. B. *Astrophys. J.*, 97, *pp.* 388–393, *May*, 1943.—The 1940 shell spectrum of HR 8731 was similar to that of ζ Tauri in 1914. This paper presents an analysis of the spectrum in which lines of H, O I, Mg I, Mg II, Si II, Ca I, Ca II, Ti II, Cr II, Fe I, Fe II, Sr II, Sc II and Ni II were identified. HR 8731 may be the brighter component of a long-period binary. When the shell spectra of γ Cassiopeiae, ζ Tauri, ε Capricorni, β Monocerotis, Pleione, HR 8731 and ψ Persei are compared, it is found that they can be arranged in order of decreasing excitation conditions in the shell. The primary difference betw. various shells is one of ionization rather than composition.

2135 523.872

The spectrum of Pleione. STRUVE, O., AND SWINGS, P. *Astrophys. J.*, 97, *pp.* 426–442, *May*, 1943.—The rad. vel. of Pleione shows oscillations with a range of 10 km./sec. and a period of 4 months. The mean vel. is + 5·5 km./sec. The spectrum of the shell has become stronger and now resembles the metallic spectrum of α Cygni. Dilution effects are conspicuous in the weakness of Mg II and Si II. Among the lines of ions having metastable lower levels, Ni II and Fe II became conspicuous in 1940, Ti II in 1941 and Mn II in 1942. This order is not consistent with the ordinary theory of ionization, and its explanation must be sought in the conditions of excitation of the metastable levels in the shell. The central intensities of the cores of the H lines are about 10% of the central intensities of the corresp. lines in α Cygni. The metallic lines on the violet side of the Balmer limit and betw. the higher members of the series are rel. stronger than in α Cygni.

See Abstr. 2126 523.872 : 523.841.11

2136 523.874

Dwarf M stars found spectrophotometrically. First list. VYSSOTSKY, A. N. *Astrophys. J.*, 97, *pp.* 381–387, *May*, 1943.—Gives a table of 82 dwarf stars detected, without previous knowledge of their motions, by their appearance on the McCormick objective prism plates. Proper motions for 79 of these stars are given. The mean abs. mag. of the dM0 stars is 8·4, while for the dM2 stars it is 9·9.

Data concerning the velocity ellipsoids (prolate spheroids) are given. The peculiar velocities are consistent with equipartition of energy.

2137 523.876 : 523.841.332

The spectra of U-Geminorum-type variable stars. ELVEY, C. T., AND BABCOCK, H. W. *Astrophys. J.*, 97, *pp.* 412–425, *May*, 1943.—Spectrograms of several U Geminorum variable stars and of a few related objects were obtained with the Cassegrain spectrographs on the 82 in. telescope. The linear dispersions varied from 75 Å/mm. to 340 Å/mm. at Hγ. Descriptions of the spectra of the following objects are given for one or more phases in their light-curves: UU Aql, SS Aur, SS Cyg, U Gem, X Leo, AY Lyr, RU Peg, SU UMa, TW Vir, RX And, Z Cam, AH Her, CN Ori, TZ Per, EY Cyg, CY Lyr, CO Ori, UX Ori, CL Sco, T Pyx and V Sge.

2138 523.99

Occultations observed at the Royal Observatory, Cape of Good Hope, in 1941 and 1942. *Mon. Not. Roy. Astr. Soc.*, 103, 1, *pp.* 38–40, 1943.

2139 523.99

Occultations observed at Cape Town and Durban in 1941 and 1942. KRUMM, H. E., AND COUSINS, A. W. J. *Mon. Not. Roy. Astr. Soc.*, 103, 1, *pp.* 42–43, 1943.

PHYSICS: GENERAL

See Abstr. 2109 53 : 521 : 519.21

2140 53 : 628.8

Applications of physics to the heating and ventilation of buildings. DUFTON, A. F. *J. Sci. Instrum.*, 20, *pp.* 106–110, *July*, 1943.—[Abstr. 796 (1943)].

2141 530.12 : 513.735.92

On null geodesics and null-corpuscles in the theory of relativity. PENDSE, C. G. *Phil. Mag.*, 34, *pp.* 377–393, *June*, 1943.—The rule $\delta\int ds = 0$, in the established general theory of relativity, is inadequate to describe the path of a particle as well as a photon (alternatively a ray of light), along whose path $ds = 0$, in the space-time continuum. It is necessary to introduce a variable τ, extraneous to the continuum and related to it in the same way as time is related to space in Newton's ideology, and the path of a particle or a photon (a ray of light) in the space-time continuum is described by the equation $\delta\int(ds/d\tau)^2 d\tau = 0$, while $ds = 0$ along the path of a photon (a ray of light).

2142 530.14

Recent advances in the theory of the fundamental particles of physics. FOWLER, R. H. *Nature, Lond.*, 151, *pp.* 628–629, *June* 5, 1943.—A review of the presidential address given by Bhabha at the Indian Science Congress. It deals with the generalization of the basic concepts of physics, and progress recently made in eliminating infinities and divergent results from the relativistic (non-quantum) theory of the point electron. The programme for the formulation of a relativistic quantum theory put forward provides the usual fundamental particles. The light point particles (electrons, positrons, neutrinos) interact through their electromagnetic fields. The heavy point particles (protons, negative protons, neutrons) interact through both electromagnetic and meson fields. Mesons are also required. A. J. M.

2143 530.145.6

On the particle equation of the meson. HEITLER, W. *Proc. Roy. Irish Acad. A*, 49, 1, *pp.* 1–28, *April*, 1943.—The Kemmer equation [Abstr. 4466 (1939)] is discussed and compared with the equation of Sakata and Taketani, which is derived from Kemmer's equation by eliminating the redundant components of the wave function. The derivation of Sakata and Taketani's equation is amplified, and their results are discussed. The electromagnetic moments of a free meson with spin 1 are calculated. A. J. M.

See Abstr. 2106 531.258 : 517.944

2144 531.718 : 666.11

Glass for precision gauges. STONE, J. A. *Machinist*, *pp.* 1–5, *June* 5, 1943.—[Abstr. 1977 B (1943)].

2145 531.765 : 778.5

Simple time base for a high-speed cine-camera. EYLES, E. D. *J. Sci. Instrum.*, 20, *pp.* 114–115, *July*, 1943.—The time base consists of an electrically maintained 1 000 c./s. tuning fork carrying slit apertures in overlapping plates at the ends of the prongs. Light from a small tungsten filament lamp is concentrated on the slits by an optical system, and an image is focused on the film. As the fork vibrates, the slits are displaced rel. one to the other and the light beam is interrupted to produce a series of dashes photographed along the edge of the film.

2146 532.13

The viscosity of pitches. FAIR, W. F., JR., AND VOLKMANN, E. W. *Industr. Engng Chem.* (*Analyt. Edit.*), 15, *pp.* 235–239, *April* 15, 1943.—A simplified falling-co-axial-cylinder viscometer was devised. Results obtained for a group of pitches indicate viscous flow at 25·0° C. and better temperature susceptibilities below the softening points than at higher temperatures. Studies on a special pitch distillate demonstrate that this material changes upon standing with progressive increase in apparent viscosity and probable development of yield values.

2147 532.13

Viscosity of coal-tar residues. Comparison of viscosity measurements and A.S.T.M. penetration tests. FAIR, W. F., JR., AND VOLKMANN, E. W. *Industr. Engng Chem.* (*Analyt. Edit.*), 15, *pp.* 240–242, *April* 15, 1943.—The results of a number of viscosity determinations and the corresp. penetration values of various pitches exhibiting viscous flow are presented and correlated. The Saal formula seems reliable above penetration values of 60 dmm. Below this value considerable deviations are apparent.

2148 532.133

The viscosity of sulphur. BACON, R. F., AND FANELLI, R. *J. Amer. Chem. Soc.*, 65, *pp.* 639–648, *April*, 1943.—The viscosity of pure S is indep. of the rate of heating and cooling and of previous heat treatment. The viscosity/cooling curve coincides with the heating curve. The low viscosities given by preheated S containing organic matter are due to the formation of H_2S. The effect of gases and halogens on the viscosity of S is described.

2149 532.133 : 532.79

The viscosity of dilute solutions of long-chain molecules. V. Dependence on the solvent. HUGGINS, M. L. *J. Appl. Phys.*, 14, *pp.* 246–248, *May*, 1943.—

he considerations of previous papers [Abstr. 4241 939), 1022 (1943)], on the effect of the nature of ne solvent on the viscosity of solutions of long-chain olecules, are now put on a semiquantitative basis. taudinger's rel. betw. η_{sp}/c and the mol. wt. of a ain-molecule solution, which applies only if the ain molecules are linked in a purely random way, ust be modified by taking account of cohesive energy ensity. Data from the literature on polystyrene and olybutene solutions agree with this conclusion.

H. H. HO.

2150 532.133 : 536.7

The properties of liquid sulphur. POWELL, R. E., ND EYRING, H. *J. Amer. Chem. Soc.*, 65, *pp.* 648–54, *April*, 1943.—The available measurements of the quilibria betw. 8-membered S rings and S chains f all lengths are interpreted in terms of a quantitative ermodynamic theory. The viscosity is formulated n terms of current theories and the calc. and exp. alues compared.

2151 532.137

A method of viscosity measurement in the region 08 poises. COX, S. M. *J. Sci. Instrum.*, 20, *pp.* 113–15, *July*, 1943.—A method using spherical imprint is escribed, particularly in connection with the viscosi- ies of glasses in their softening range. The formula iving the viscosity in terms of the radius of imprint, a, he compressive force, P, the time, T, and the radius f the sphere, R, is $\eta = 9PRT/16a^3$.

See Abstr. 2227 532.137 : 539.501

2152 532.516

The fundamental problem of the theory of viscous luids. PUTMAN, H. *J. Appl. Phys.*, 14, *pp.* 244–245, *May*, 1943.—A theorem is proved, giving the value f $d(\nabla.\vec{v})/dt$ for viscous fluids. With the known alue of $d\vec{\omega}/dt$, it gives a theoretical method of tudying viscous fluids.

2153 532.516 : 621.89

Studies in lubrication. XI. Temperature behaviour f journal bearing systems. MUSKAT, M., AND MORGAN, F. *J. Appl. Phys.*, 14, *pp.* 234–244, *May*, 943.—Transient bearing temperature and friction lata were obtained for a journal bearing system perating under thick-film conditions. The journal peed was varied from 1·5 to 11·0 r.p.s., and tests were made with 5 different lubricants. Equilibrium values of temperature and friction were determined by exponential extrapolation of data taken over time intervals of 3–6 hr. Average film temperatures were calculated from the friction data. [See Abstr. 216 (1942)].

2154 532.517.4

Vortices in fluid flow. PORITSKY, H. *J. Math. Phys.*, 21, *pp.* 218–239, *Dec.*, 1942.—Viscosity by itself is not a cause of vorticity but it causes vorticity to diffuse throughout the fluid; combined with the effect due to immersed solids it may initiate vortices. In the case of a finite aerofoil their re-entry is by means of the surface of discontinuity trailing behind the aerofoil, viz. the surface along which the flow re-unites after it had been separated by the aerofoil. For aerofoils above the stalling angle and behind cylinders and bluff objects, the flow departs from the solid surfaces and the resulting discontinuities in flow are equiv. to vortex distributions. Failure of fluid to stay along a single curve in the equation-of-state plane may cause vortices to appear. Vortices are responsible for the lift of an aerofoil and for the thrust of fans and propellers.

J. S. G. T.

See Abstr. 2157 532.612.4 : 532.7

2155 532.64.08

Optical method of measuring the angle of contact. KHAMBATA, S. J., AND SAHIAR, A. B. *J. Univ. Bombay*, 11, *pp.* 52–55, *March*, 1943.—A photographic record is obtained of interference fringes formed in the liquid film. Measurement of the fringes enables a calculation to be made of the thickness variation of the film at the edge of the contact. The angle of contact of air/turpentine/glass was found to be nearly 0·4°, whereas the accepted value is 17°. For water, when the glass is very carefully cleaned, the authors establish that the angle of contact of air/water/glass is zero.

A. E. T.

2156 532.694.1

Current methods of measuring foam. ROSS, S. *Industr. Engng Chem.* (*Analyt. Edit.*), 15, *pp.* 329–333, *May* 15, 1943.—The chief methods, static and dynamic, currently employed to measure foaminess of liquids have been examined to ascertain the factors involved, since each measures a somewhat different complex of properties, such as drainage, apart from mere collapse or coalescence of bubbles. For a film of a given stability the average life of a bubble is greater the smaller the bubble, increasing at least in inverse proportion to the (dia.)^2. Methods are suggested for examining the stability of foams with a min. of complications.

2157 532.7 : 532.612.4

A statistical theory of liquids. II. JAFFÉ, G. *Phys. Rev.*, 63, *pp.* 313–321, *April* 1 *and* 15, 1943.—[See Abstr. 614 (1943)]. V.p., surface tension and the neighbourhood of the critical point are discussed. The exp. values of the ht. of vap. are 55% higher than the calculated values for the 10 liquids studied. This suggests association in the liquid phase. The nbr. of mol. per sq. cm. of surface can be defined by the aid of integrals involving the potential of molecular interaction. If a molar surface S^* is defined as a surface containing 1 mole of the liquid, the eq. of state for the surface phase assumes the form $\gamma S^* = RT$. Eötvös' law follows as a lim. law for high temperatures.

See Abstr. 2248 532.71 : 536.7 : 541.134

2158 532.71 : 541.18

Osmotic properties of solutions of some typical colloidal electrolytes. MCBAIN, J. W., AND BOLDUAN, O. E. A. *J. Phys. Chem.*, 47, *pp.* 94–103, *Feb.*, 1943.—Following the very dilute region in which practically only ions are present, there is a range in which the conc. increases tenfold while the f.p. is only slightly lowered. During this range, the average composition of the micelles is progressively changing. After the osmotic coeff. precipitously falls off throughout a tenfold increase in conc., the process comes to an abrupt end; thereafter, the osmotic coeff. remains const. at a low value, the lowering of the f.p. being approx. $\propto$ conc.

2159 532.771 : 539.133

Molar polarizations in extremely dilute solutions. II. DAVIS, R., BRIDGE, H. S., AND SVIRBELY, W. J. *J.*

Amer. Chem. Soc., 65, *pp.* 857–862, *May*, 1943.—The dipole moments of nitrobenzene, *m*-nitroaniline, benzamide, ethyl benzoate, chlorobenzene, *d,l*-pinene, 3,6-dichloro-2,5-dimethoxybenzoquinone and 2,3-dichloro-5,6-dimethoxybenzoquinone were measured in either benzene or dioxane as the non-polar solvent. The abnormal behaviour in polarization curves frequently obtained in very dilute solutions appears to be due to exp. error in measuring P_1 and has no physical significance.

2160 532.782 : 669.018

The constitution of magnesium-manganese-zinc-aluminium alloys in the range 0–5% magnesium, 0–2% manganese, 0–8% zinc. I. The liquidus. BUTCHERS, E., RAYNOR, G. V., AND HUME-ROTHERY, W. *J. Inst. Met.*, 69, *pp.* 209–228, *May*, 1943.—The liquidus surfaces of Al-rich alloys have been determined accurately for Mg-Zn-Al and the results are expressed in the form of an equation; the f.p. depression is less than would be expected from a purely additive relation based on the liquidus curves of the binary systems. A corresp. study has been made of Mg-Mn-Al and Mn-Zn-Al, and of Mg-Mn-Zn-Al. The alloys containing Mn divide themselves into 2 classes, in which the primary constituents on freezing are the Al-rich solid solution and the compound $MnAl_6$, respectively. Equations are given for the liquidus points of both phases, and for the binary eutectic surface in the quaternary system.

See Abstr. 2149 532.79 : 532.133

2161 533.17.08 : 542.7

An improved meter for the measurement of gas flow rates. APPLEBY, W. G., AND AVERY, W. H. *Industr. Engng Chem.* (*Analyt. Edit.*), 15, *pp.* 349–350, *May* 15, 1943.

See Abstr. 2263 533.6 : 797.5 : 551.5

2162 533.7

The forces between hydrogen molecules. MARGENAU, H. *Phys. Rev.*, 63, *pp.* 385–386, *May* 1 *and* 15, 1943.

SOUND. VIBRATIONS

2163 534.01 : 517.432.1 : 621.3.015.3

Transient analysis of linear systems. OSBORNE, M. F. M. *J. Appl. Phys.*, 14, *pp.* 180–184, *April*, 1943.—[Abstr. 1821 B (1943)].

2164 534.321 : 788.5

Pressure variation of pitch of a flute pipe. RAY, K. *Sci. and Cult.*, 8, *pp.* 425–426, *April*, 1943.

2165 534.647 : 621.317.39

An electrical transducer circuit for use with capacitance pick-up devices. POTTER, E. V. *Rev. Sci. Instrum.*, 14, *pp.* 130–135, *May*, 1943.—[Abstr. 1857 B (1943)].

2166 534.75

Bone-conduction threshold measurements: effects of occlusion, enclosures, and masking devices. WATSON, N. A., AND GALES, R. S. *J. Acoust. Soc. Amer.*, 14, *pp.* 207–215, *April*, 1943.—It is known that, when the external ear canals of a normal person are closed, the bone-conduction threshold (b.c.t.) is shifted to a lower intensity which depends on the frequency applied. With a vibrator applied at the centre of the forehead, and both ears completely occluded, the shift in the b.c.t. was − 24 db. A shift is also produced by covering the ears with enclosures having volumes smaller than the critical values (which vary with frequency). Similar but smaller effects are produced by occlusion of one ear or by covering one ear. The use of a masking phone over the better ear of an observer while testing the bone acuity of the poorer ear often results in a spurious threshold. A better device for this purpose is suggested. G. E. A.

2167 534.862

Acoustic performance of 16-millimeter sound motion-picture projectors. SNYDER, W. F. *Circ. U.S. Bur. Stand., No.* 439, [56 *pp.*], 1942.—Presents information to assist in preparing a specification and in selecting equipment of good performance. Objective test methods are described in detail, and simplified methods of sound measurements are indicated.

2168 534.862.3

Sibilant speech sounds. MILLER, B. F. *Electronic Engng*, 16, *pp.* 69–70, *July*, 1943.—From a study of the spectral distribution of speech energy a method giving satisfactory reduction of sibilants has been developed. The correction is obtained by inserting an equalizer betw. the compressor output terminals and the control-rectifier input circuit, the loss characteristic of this equalizer being designed to vary with frequency according to the inverse of the speech pressure/frequency curve. Recordings made with the modified compressor are free from exaggerated sibilance, while exhibiting a brilliance equivalent to that obtained during reproduction of normal uncompressed recordings. A. W.

OPTICS

See Abstr. 2197 535.3 : 548.73 : 537.531

2169 535.322.1

An experimental mass spectrometer. COGGESHALL, N. D., AND JORDAN, E. B. *Rev. Sci. Instrum.*, 14, *pp.* 125–129, *May*, 1943.—A mass spectrometer designed for investigating different source arrangements, has been completed. It is an all-metal sector-shaped magnetic-field type, constructed so that it may be disassembled, repaired, or modified without altering its focusing properties. An important feature is a removable ion-source unit. A new source arrangement is discussed.

See Abstr. 2198 535.33 : 539.4.016.2 : 537.531

2170 535.33.072 : 669.18

Applications of the spectrograph to steelwork analysis. I–II. SHIRLEY, H. T., AND ELLIOTT, I. *Engineering*, 155, *pp.* 437–440, *May* 28, *and pp.* 456–457, *June* 4, 1943.—A general description of the type of apparatus in use is given, together with the principles of technique. Operation in rel. to sources of error is discussed and improvements suggested. The selection of line pairs is considered with ref. to satisfactory density, sensitivity, plate characteristics, etc. The methods of processing the plates and adjustments for varying the speed of the plates are set out with corrections for photographic density. The use of std. samples and chemical checks is described. Working procedure and results for 2 high-alloy steels are given. Photographic technique is described and the precautions are outlined. Low-alloy steels are

examined and results are discussed. An account is given of developments showing promising results.

M.-V.

2171 535.338.3 : 523.77

Temperature classification of gadolinium lines. KING, A. S. *Astrophys. J.*, 97, *pp.* 323–380, *May*, 1943.—Wavelength measures and temperature classifications are given for 5 775 lines of Gd from λ2 135 to λ10 677. The classification was obtained by comparing the spectra of the carbon-tube furnace at 3 temperatures with those of the arc and spark. Features of these spectra in successive wavelength regions are described. A comparison with the solar spectrum showed that approx. 60 lines of Gd II are probably present, though sometimes masked, in the sun. These lines are very strong in the arc spectrum and have considerable strength in the furnace.

2172 535.338.42 : 512.972

Theory of complex spectra. III. RACAH, G. *Phys. Rev.*, 63, *pp.* 369–382, *May* 1 *and* 15, 1943.—The consideration of the phases of the fractional-parentage coefficients allows the extension of the matrix methods to configurations with more than 2 equiv. electrons. Tables are given for the parentages of the terms of p^n and d^n. Applications are made to the spin-orbit interaction of the d^n terms and to the electrostatic interaction betw. the configurations d^n, $d^{n-1}s$ and $d^{n-2}s^2$. Errata to Part II. [Abstr. 634 (1943)].

See Abstr. 2175 535.338.42 : 535.375.5

See Abstr. 2191 535.338.42 : 541.66 : 536.7

See Abstr. 2254 535.347 : 535.37 : 541.143

See Abstr. 2254 535.37 : 535.347 : 541.143

2173 535.371

Fluorescence of anthracene in presence of naphthacene. GANGULY, S. C. *Nature, Lond.*, 151, *p.* 673, *June* 12, 1943.

2174 535.375.5

Raman spectra of hydrocarbons. II. 2-methyl-1-heptene and 6-methyl-1-heptene. CLEVELAND, F. F. *J. Chem. Phys.*, 11, *pp.* 227–230, *May*, 1943.—Raman frequencies, rel. intensities and depolarization factors are listed for 2-methyl-1-heptene and 6-methyl-1-heptene. The results are compared with data obtained previously [Abstr. 1064 (1943)]. Polarized lines at 1 643 and 3 000 and depolarized (or only slightly polarized) lines at 1 294, 1 416 and 3 078 cm.$^{-1}$ corresp. to olefinic frequencies of the $XHC{=}CH_2$ group. When the group is $XYC{=}CH_2$ these frequencies appear at 1 653, 2 978, 1 303, 1 414 and 3 077, the depolarization factors remaining unaltered.

2175 535.375.5 : 535.338.42

Infra-red and Raman spectra of polyatomic molecules. XIX. Acetaldehyde and acetaldehyde-d_4. MORRIS, J. C. *J. Chem. Phys.*, 11, *pp.* 230–235, *May*, 1943.—The spectra were measured betw. 3 μ and 25 μ. An analysis of the spectra is made and values are suggested for the fundamental vibration frequencies of these molecules. These values are compared with the assignment for the propylene molecule, and a strong similarity is shown. The results are used to calculate the ht. of the potential barrier restricting internal rotation in acetaldehyde, and a value of about 2 000 cal. is deduced.

2176 535.393

Determination of optical constants of metals by reflectivity measurements. COLLINS, J. R., AND BOCK, R. O. *Rev. Sci. Instrum.*, 14, *pp.* 135–141, *May*, 1943.—The reflectivity of linearly polarized light at various angles of incidence on plane evaporated samples of pure metals is measured from 4 800 Å to 24 000 Å. A graphical method for obtaining the optical constants from the data is worked out.

See Abstr. 2199 535.4 : 537.531

2177 535.421

A simple method of demonstrating diffraction-grating effects. BRAGG, L., AND LIPSON, H. *J. Sci. Instrum.*, 20, *pp.* 110–113, *July*, 1943.—A description is given of an apparatus with which diffraction at very small angles can be observed. It provides a simple way of demonstrating diffraction by large objects, and the orders of diffraction from gratings of 1 mm. spacing are well separated. It is possible to introduce faults into gratings to illustrate effects that could arise in practice. Several gratings are described and the diffraction patterns from them are discussed with ref. to certain X-ray diffraction effects from transition structures in alloys.

2178 535.55 : 621.385.032.7

Glass strain. NOLTE, H. J. *Gen. Elect. Rev.*, 46, *pp.* 275–280, *May*, 1943.—In the polariscope described, a sheet of polaroid film betw. glass plates serves as polarizer, the analyser having binocular polaroid lenses and both polarizer and analyser axes are inclined at 45° to the vertical. Selenite retardation plates are fitted to the lower portions of the polaroid lenses and are of such a thickness that the light transmitted is predominantly yellow. These plates are useful in discriminating betw. tensional and compressional stresses. A set of standardized strain discs enables a numerical value to be assigned to the strain in any particular glass specimen. Difficulties due to refraction and surface reflections may be eliminated by immersing the specimen in alcohol or other liquid with a refr. index close to that of the glass in question. Typical strain patterns are discussed and examples given of faults frequently found in various processes of the manufacture of valves and valve parts.

A. W.

2179 535.733

Spectral sensitivity of the retinal receptors. WRIGHT, W. D. *Nature, Lond.*, 151, *pp.* 726–727, *June* 26, 1943.

2180 535.733.1

The evolution of colour vision. WALLS, G. L. *J. Appl. Phys.*, 14, *pp.* 161–165, *April*, 1943.—Discusses the reasons which may have led to the development of a colour sense in man and some other animals. The author points out that it is associated with a cone mechanism in the eye and this, in turn, is associated with diurnality of the animal and with the development of accommodative mechanism.

J. W. T. W.

2181 535.736

Visual purple. GRANIT, R. *Nature, Lond.*, 151, *pp.* 631–632, *June* 5, 1943.—A summary of researches on the chemical nature of the visual purple and its products, particularly the work of Lythgoe [see *Brit. J. Ophthal.*, 24, *p.* 21, 1940].

J. W. T. W.

2182 535.736

A summary of researches in seeing at low brightness levels. LUCKIESH, M., AND TAYLOR, A. H. *Illum. Engng, N.Y.*, 38, *pp.* 189–207, *April*, 1943.—Describes the results of investigations into different aspects of vision at low brightness levels. The sensitivity of the eye to energy at different wavelengths at the threshold of visibility was determined. The rate of dark-adaptation to monochromatic light of various wavelengths, the effect of pre-adaptation and the effect upon adaptation of exposing the eyes to low-brightness areas of different colours were studied. An extensive series of tests was carried out on visual acuity in coloured light at low brightness.

J. W. T. W.

HEAT. THERMODYNAMICS

2183 536.2 : 541.128

Conduction, convection and heat release in catalytic convertors. WILHELM, R. H., JOHNSON, W. C., AND ACTON, F. S. *Industr. Engng Chem.*, 35, *pp.* 562–575, *May*, 1943.—Solutions are presented for thermal equations involving the rate of heat generation in cylindrical and slab-shaped catalyst beds, the rate of heat removal by convection betw. solid and gas, and its removal by conduction through the catalyst and gas in a direction $\perp$ the gas stream. The functions are plotted in dimensionless form. Assumptions include uniform gas temp. at every cross-section and small longitudinal-solids temp. gradient comp. with the transverse gradient.

2184 536.242

Design of solid-fluid heat exchangers. LOVELL, C. L., AND KARNOFSKY, G. *Industr. Engng Chem.*, 35, *pp.* 391–397, *April*, 1943.—A method is presented for solving the problem of continuous, parallel or countercurrent exchange of heat betw. solid particles and a fluid, taking into account the resistance to heat transfer by conduction within the solids. The particles are assumed spherical.

2185 536.413.2 : 621.317.39

A recording dilatometer for metal specimens. STANTON, L. R. *Iron and Steel*, *pp.* 361–362, *May*, 1943.—[Abstr. 569 B (1943)].

2186 536.532

A plug-in thermocouple head. JONES, S. R. *J. Sci. Instrum.*, 20, *p.* 116, *July*, 1943.

2187 536.581

Thermostat bath. *J. Sci. Instrum.*, 20, *pp.* 117–118, *July*, 1943.

2188 536.631

Specific heats at low temperatures of manganese carbide and manganese dioxide. KELLEY, K. K., AND MOORE, G. E. *J. Amer. Chem. Soc.*, 65, *pp.* 782–785, *May*, 1943.—[See Abstr. 1318 (1941)]. MnO_2 has a marked anomaly in its sp. ht. curve with the peak at $(92{\cdot}12 \pm 0{\cdot}05)$°K. The total heat absorbed betw. 85° and 100°K. was 102·5 cal. per mole. The entropy values were computed for Mn_3C and MnO_2.

2189 536.653

Heats of dilution and relative heat contents of aqueous solutions of lanthanum chloride and lanthanum sulphate at 25°. NATHAN, C. C., WALLACE, W. E., AND ROBINSON, A. L. *J. Amer. Chem. Soc.*, 65, *pp.* 790–794, *May*, 1943.—The results in dilute solutions fail to reveal an approach to the Debye–Hückel theory even at the lowest measured concentrations.

2190 536.66

Heats of formation of manganomanganic oxide and manganese dioxide. SHOMATE, C. H. *J. Amer. Chem. Soc.*, 65, *pp.* 785–790, *May*, 1943.—The heat of formation of Mn_3O_4 was obtained by 2 solution methods involving the use of H_2SO_4-KI solutions and H_2SO_4-$Fe(NH_4)_2(SO_4)_2$ solutions. The heat of formation of MnO_2 was obtained by 2 solution methods involving the use of $Fe(NH_4)_2(SO_4)_2$ solutions, with and without the use of H_2O_2.

See Abstr. 2150 536.7 : 532.133

See Abstr. 2248 536.7 : 532.71 : 541.134

2191 536.7 : 541.66 : 535.338.42

The thermodynamics and molecular structure of benzene and its methyl derivatives. PITZER, K. S., AND SCOTT, D. W. *J. Amer. Chem. Soc.*, 65, *pp.* 803–830, *May*, 1943.—The heat capacity of solid, liquid and gas in appropriate ranges from 15° to 470°K., the heats of fusion and vaporization, the m.p. and v.p., the entropies of liquid and gas, the free-energy function $(H_0^\circ - F_T^\circ)/T$, the heat content, and the heat capacity over the range 298°–1 500°K., were measured, calculated, or taken from the literature for benzene, toluene, *o*-, *m*- and *p*-xylene. The f.p. diagram for the ternary system *o*-, *m*- and *p*-xylene was derived by calculation, and certain points experimentally verified. The direct isomerization reaction of the xylenes, catalysed by $AlBr_3$ and HBr, led to the equilibrium composition. The thermodynamic const. were calculated. By consideration of the lines appearing in the infra-red and Raman spectra of liquid, but not of gaseous, benzene, it has been possible to complete the assignment of fundamental vibration frequencies. The spectra of the simpler deuterated benzenes were considered. Attention is drawn to the behaviour of the 1 000 $cm.^{-1}$ line in benzene derivatives which are substituted in only 1 : 3 : 5-positions. Corresp. effects are observed where the trigonal positions are all similarly substituted. The mol. structure data indicate relatively free rotation of methyl groups in toluene, *m*- and *p*-xylene but about a 2 000 cal. potential barrier for *o*-xylene. The xylene data show the meta compound to have the lowest energy. H. H. HO.

2192 536.7 : 620.19

Thermodynamic considerations in the corrosion of metals. WARNER, J. C. *Trans. Electrochem. Soc.*, 83, *Prepr. No.* 5, [14 *pp.*], 1943.—[Abstr. 1814 B (1943)].

2193 536.755

A note on entropy and irreversible processes. EHRENBERG, W. *Phil. Mag.*, 34, *pp.* 396–409, *June*, 1943.—On the basis of an analysis of the notion "body" in thermodynamics, irreversible processes are classified as conduction and as breaking-up processes. A new derivation of $dS = dQ/T$ is given on the basis of Clausius' principle, and it is shown that this relation is not restricted to reversible processes, but holds for irreversible conduction processes as well. Bridgman's hypothesis, the theory of Carathéodory and Born, and the bearing of the new derivation on

the interpretation of the equilibrium conditions, are discussed.

ELECTRICITY. MAGNETISM

See Abstr. 2210 537.133 : 539.185 : 539.132

2194 537.226.8 : 621.385.1

Effect of high-frequency voltage on dielectric constant of space containing electrons. GHOSH, S. *Curr. Sci.*, 8, *pp.* 53–54, *Feb.*, 1943.

2195 537.312

The effect of high electrostatic fields upon the vaporization of molybdenum. ESTABROOK, G. B. *Phys. Rev.*, 63, *pp.* 352–358, *May* 1 *and* 15, 1943.—For field strengths of $0{\cdot}52 \times 10^6$ V/cm. or less at the wire surface, there is no change in the rate of change of resistance with time, and hence the rate of vaporization, upon application of the field; for field strengths $> 0{\cdot}52 \times 10^6$ V/cm. the rate of vaporization first decreases slowly, then more rapidly, and finally asymptotically toward zero at field strengths $> 1{\cdot}8 \times 10^6$ V/cm.; with increasing temperatures, the same field strength applied at the surface of a wire produces progressively smaller decreases in the rate of vaporization; when there is an effect upon the rate of vaporization, sudden increases in resistance occur when the field is applied, and sudden decreases when it is removed.

2196 537.312

The effect of high electrostatic fields upon the vaporization and resistance of molybdenum filaments. REID, W. P. *Phys. Rev.*, 63, *pp.* 359–366, *May* 1 *and* 15, 1943.—It is suggested that the resistance changes were due to temperature changes resulting from small changes in emissivity; resistance changes in different directions were due to spectral variation in the behaviour of the emissivity of a filament when it is coated with gas.

2197 537.531 : 535.3 : 548.73

Thermal scattering of X-rays by crystals. BEGBIE, G. H., AND BORN, M. LONSDALE, K. *Nature, Lond.*, 152, *pp.* 19–20, *July* 3, 1943.—[See Abstr. 2479 (1942)].

2198 537.531 : 535.33 : 539.4.016.2

X-ray line broadening by cold-working alpha-brass. PETERSEN, M., AND TUCKER, C. W. *Phys. Rev.*, 63, *p.* 385, *May* 1 *and* 15, 1943.—[See Abstr. 699 (1943)].

2199 537.531 : 535.4

The diffraction of X-rays by liquid elements. GINGRICH, N. S. *Rev. Mod. Phys.*, 15, *pp.* 90–109, *Jan.* 1943.—A review. Gives the theory of the diffraction of X-rays by liquids, describes the experimental techniques employed, and summarizes the work carried out on 23 elements in the liquid state. Atomic distribution curves are given for 16 of these. J. T.

2200 537.531 : 548.73 : 591.111.2

X-ray analysis of haemoglobin. BOYES-WATSON, J., AND PERUTZ, M. F. *Nature, Lond.*, 151, *pp.* 714–716, *June* 26, 1943.—A continuation of previous work [Abstr. 1830 (1942)], based on the computation of direct Fourier syntheses for horse haemoglobin crystals at different shrinkage stages. The haemoglobin molecule is found to be a platelet having the approx. dimensions $36\,\text{Å} \times 64\,\text{Å} \times 48\,\text{Å}$. It is rigid under the ordinary conditions of swelling and contraction, and it is probably made up of 4 parallel layers of scattering matter which are a little less than 9 Å apart. J. T.

2201 537.531.8

Production of ion clusters by X-rays. FANO, U. *Nature, Lond.*, 151, *p.* 698, *June* 19, 1943.

See Abstr. 2205 537.533.8 : 537.591.15

See Abstr. 2217 537.534.6 : 539.185

2202 537.591.1

Further tests of the atom-annihilation hypothesis as to the origin of the cosmic rays. MILLIKAN, R. A., NEHER, H. V., AND PICKERING, W. H. *Phys. Rev.*, 63, *pp.* 234–245, *April* 1 *and* 15, 1943.—Tests in Mexico confirm the predictions made on the basis of Si-annihilation [see Abstr. 1840 (1942)], concerning the appearance of bands at various latitudes. Tests in U.S.A. also agree with the theory. The annihilation of atoms transforms the rest mass energy of the atom into an electron pair. A. J. M.

2203 537.591.1

Mesotron mass and heavy tracks on Mt. Evans. NIELSEN, C. E., AND POWELL, W. M. *Phys. Rev.*, 63, *pp.* 384–385, *May* 1 *and* 15, 1943.

2204 537.591.1 : 538.691

On the stability of principal periodic orbits in the theory of primary cosmic rays. LIFSHITZ, J. *J. Math. Phys.*, 21, *pp.* 284–292, *Dec.*, 1942.—A family of periodic solutions of the equations of motion of a charged particle in the field of a magnetic dipole is discussed. The characteristic exponents of these principal periodic orbits are a measure of their stability, and are found by studying the motion of a particle in the vicinity of a periodic orbit. This is done by Godart's method for external and internal orbits far from the limiting orbit separating the two, and by the method of the secular determinant for other orbits. A graph shows the range of stability of the various orbits. A. HU.

2205 537.591.15 : 537.533.8

Production of bursts by meson and its dependence on the meson spin. CHAKRABARTY, S. K. *Indian J. Phys.*, 16, *pp.* 377–392, *Dec.*, 1942.—An analytic expression is derived for the calculation of the frequency of bursts produced by a meson. Three different values for the spin, 0, $\frac{1}{2}$ and 1, are taken into consideration and the results compared with exp. results. For a meson, spin 0 or $\frac{1}{2}$ is not a possibility, whereas spin 1 is probable, provided the effect of the radiation damping be taken into consideration.

2206 537.591.5

Intensity of cosmic rays at low altitude and the origin of the soft component. GREISEN, K. *Phys. Rev.*, 63, *pp.* 323–333, *May* 1 *and* 15, 1943.—Absorption curves were obtained with absorbers of C, Fe and Pb. The sep. intensities of fast mesotrons, slow mesotrons and electrons are deduced from the differences betw. the curves. The number of slow mesotrons is $>$ the number which may have descended from the mesotrons observed at a higher altitude, thus indicating considerable production of low-energy mesotrons at low altitudes. The number of electrons is much too small to allow the conclusion that all of the energy of decaying mesotrons goes into shower production. Unless the lifetime/mass ratio for mesotrons is $>$

presently accepted values, the results favour the conclusion that $< \frac{1}{2}$ of the energy of the mesotrons goes to the electron component.

2207 538.31

A variant of Maxwell's experiment on the movement of magnets about a straight conductor. PARK, H. E. *Nature, Lond.*, 151, *pp.* 697–698, *June* 19, 1943.

2208 538.566.029.64 : 621.396.11.029.64

Ultra-high-frequency oscillations of cylindrical cavity resonators containing two and three dielectric media. MIDDLETON, D. *Phys. Rev.*, 63, *pp.* 343–351, *May* 1 *and* 15, 1943.—The mathematical problem of the perfectly conducting cylindrical cavity resonator containing 2 and 3 dielectrics is set up and solved in terms of the electric and magnetic vector potentials. The rel. betw. natural frequencies and resonant lengths are discussed, in particular for a cyl. resonator containing a movable slab of dielectric. Modes of the form E_{np0} and H_{np0} are not excitable if there is more than 1 dielectric present. The band-transmission characteristics of such resonators are considered, and an abs. method for the measurement of permittivity at microwave frequencies is suggested. Exp. measurements were made at 3 070 Mc./s. for the H_{111} mode, and the results agree with theory.

See Abstr. 2204 538.691 : 537.591.1

MOLECULAR AND ATOMIC PHYSICS

2209 539.13

The structure of the protein molecule. DERVICHIAN, D. G. *J. Chem. Phys.*, 11, *pp.* 236–246, *May*, 1943.—A 2-dimensional double layer of amino acids is postulated as the constitution of proteins in solution. From the known size of a single amino acid residue, the shape and size of a protein mol. of mol. wt. class 3 500 may be estimated. The denatured molecules are postulated to have a filamentous or fibrous form, characterized by the polypeptide chain. The evidence for such a postulate is reviewed.

2210 539.132 : 537.133 : 539.185

Meson theory of the magnetic moment of proton and neutron. JAUCH, J. M. *Phys. Rev.*, 63, *pp.* 334–342, *May* 1 *and* 15, 1943.—The m.m. of proton and neutron is determined by a second-order perturbation calculation. A new lim. process secures the convergence of the integration in momentum space. The result for pseudoscalar and vector mesons is the same and leads to a + m.m. for the neutron if the m.m. of the vector meson is assumed to be 1 meson magneton ($e\hbar/2\mu c$). Agreement with the known values of the m.m. of the heavy particles can only be obtained if the vector meson is given an anomalous m.m. of 3 meson magnetons.

2211 539.133

The electric moments of some substituted benzoic acids. II. The moments of *o*-, *m*- and *p*-fluorobenzoic acids, and of *o*-chloro- and *o*-bromobenzoic acids. HOBBS, M. E., AND WEITH, A. J., JR. *J. Amer. Chem. Soc.*, 65, *pp.* 967–971, *May*, 1943.—The values are 2·10, 2·16, 1·99, 2·43 and 2·50, respectively. Calculation of the angle the carboxyl group moment makes with the ϕ–C axis gives a value of 74° if the moment of *p*-fluorobenzoic acid is used. This along with previously determined angle values from *p*-chloro- and *p*-bromobenzoic acid gives an average value of 74°.

See Abstr. 2159 539.133 : 532.771

2212 539.16 : 550.422

The distribution of helium and radioactivity in rocks. V. Rocks and associated minerals from Quebec, Ontario, Manitoba, New Jersey, New England, New Brunswick, Newfoundland, Tanganyika, Finland and Russia. KEEVIL, N. B. *Amer. J. Sci.*, 241, *pp.* 277–306, *May*, 1943.—The radioactive contents and the He indexes of more than 25 rocks and associated minerals were determined. Low values of the He index are attributed to escape of He; occasionally extraneous He is present. The mafic minerals are generally 3 times as active as the felsic constituents of a rock, and conc. of the radioactivity of a rock in its accessory minerals is often indicated. [See Abstr. 971 (1943)].

2213 539.164.1.08

Theory of alpha-ray counting from solid sources. KEEVIL, N. B., AND GRASHAM, W. E. *Canad. J. Res.*, 21, *pp.* 21–36, *March*, 1943.—The theory of α-ray counting from thin sources of atomic dimensions, from layers whose equiv. thickness is $<$ the range of the particle, and from thick sources, is developed, assuming uniform collection over the surface such as obtained in parallel-plate collection chambers, with and without absorbers. For α-ray counting from rocks which contain 25 α-ray emitters, equations and curves are given which can be used in computing actual emission from observed count. A test by exp. results on granite is given.

2214 539.166.2

The disintegration scheme of Na^{24}. ELLIOTT, L. G., DEUTSCH, M., AND ROBERTS, A. *Phys. Rev.*, 63, *pp.* 386–387, *May* 1 *and* 15, 1943.—[See Abstr. 183 (1942), 734 (1943)].

2215 539.166.2

Gamma-rays from Na^{24} and La^{140}. MANDEVILLE, C. E. *Phys. Rev.*, 63, *pp.* 387–388, *May* 1 *and* 15, 1943.

2216 539.166.74

Erratum: A simple method for the investigation of secondary electrons excited by γ-rays and the interference of these electrons with measurements of primary β-ray spectra. MEITNER, L. *Phys. Rev.*, 63, *p.* 384, *May* 1 *and* 15, 1943.—[See Abstr. 1718 (1943)].

See Abstr. 2210 539.185 : 537.133 : 539.132

2217 539.185 : 537.534.6

On the scattering of neutrons by protons. HULTHÉN, L. *Phys. Rev.*, 63, *p.* 383, *May* 1 *and* 15, 1943.

2218 539.211 : 674.04

An analysis of the factors responsible for raised grain on the wood of oak following sanding and staining. MARRA, G. G. *Trans. Amer. Soc. Mech. Engrs*, 65, *pp.* 177–185, *April*, 1943.

2219 539.217

The permeability of transparent wrappings. OSWIN, C. R. *J. Soc. Chem. Ind., Lond.*, 62, *pp.* 45–48, *April*, 1943.—Gives results of tests of the moisture-vapour permeability of moisture-proof cellulose film, rubber hydrochloride, nitrocellulose and cellulose acetate. E. R. A.

2220 539.26 : 591.111.1

Fibrinogen and fibrin as members of the keratin-myosin group. BAILEY, K., ASTBURY, W. T., AND RUDALL, K. M. *Nature, Lond.*, 151, *pp.* 716–717, *June* 26, 1943.—X-ray photographs show that fibrinogen and fibrin belong to the keratin-myosin group of fibrous proteins, and it is considered that fibrin is an insoluble modification of fibrinogen without any fundamental change in molecular plan, but in a higher state of aggregation. It is suggested that, in a physiological blood clot, the corpuscles are formed primarily by end-to-end accretion of fibrinogen units without configurational denaturation. Non-physiological cases of blood clotting may involve a different chemical mechanism in which the α-form goes over to the β. J. T.

ELASTICITY. STRENGTH

2221 539.32 : 674.049

High-density plywood. FINLAYSON, M. *Trans. Amer. Soc. Mech. Engrs*, 65, *pp.* 193–199, *April*, 1943.—The physical properties of high-density plywood produced from Tego-bonded birch veneer, the grain direction of all plies parallel, are compared with the corresp. properties of metals. The strength properties are directly related to the sp. gravity. Stress/strain curves in tension indicate that this material not only has no normal yield point but actually shows a decrease in elongation per unit load at high loads. The moduli of elasticity in tension and compression are greatly different. The behaviour in torsion is discussed, and the effect on the tensile strength of cross-laying the veneers is presented. The effect of immersion in water and the effect of various humidity conditions are given.

2222 539.32 : 679.5

Stress/strain characteristics of vinyl elastomers. REED, M. C. *Industr. Engng Chem.*, 35, *pp.* 429–431, *April*, 1943.—The stress/strain curves of typical plasticized vinyl polymers were determined at 10°, 25° and 40°C. by an autographic machine. The diagram is a straight line up to 1 000 lb./in.^{2} during the first elongation cycle, but concave toward the load axis over the second cycle, and shows a reduction in hysteresis on repeated flexure. Vinyl elastomers exhibit a greater increase in stiffness with decrease in temperature than vulcanized rubber and a higher mod. of elasticity at room temperature. In the case of vinyl-chloride-acetate copolymers, increasing the vinyl chloride constant up to 95% reduces the temperature sensitivity. Polyvinyl butyral elastomers show greater stiffening at reduced temperatures than polyvinyl chloride-acetate copolymers.

2223 539.378.3 : 548.55

Energies for self-diffusion in zinc. HUNTINGTON, H. B. *Phys. Rev.*, 63, *pp.* 383–384, *May* 1 *and* 15, 1943.—[See Abstr. 2404 (1942)].

See Abstr. 2198 539.4.016.2 : 535.33 : 537.531

2224 539.4.016.3 : 669.144

Temper brittleness and long-time heat embrittlement. RUDORFF, D. W. *Metallurgia, Manchr*, *pp.* 24–28, *May*, 1943.—The influence of steel composition upon embrittlement characteristics is examined, the effect of the C, Cr, P, Mo and Nb content on the behaviour of the steel being investigated. Heat treatment below the Ac_1 point is discussed with ref. to the cooling speed. M.-V.

2225 539.4.016.3 : 669.6

The effect of quenching and prolonged tempering on α-base antimony-cadmium-tin alloys. II. Changes in tensile properties. PELL-WALPOLE, W. T. *J. Inst. Met.*, 69, *pp.* 259–268, *June*, 1943.—[See Abstr. 266 (1943)].—The tensile properties of alloys containing 7–10% of Sb with 0–3% of Cd were examined after the following treatments: (1) annealed to equilibrium at 150°C.; (2) quenched from max. practicable annealing temperature; (3) as (2), then tempered at 150°C.; (4), (5) and (6) as (3), then aged at 140°C. for 250, 500 and 1 000 hr., respectively; (7) air-cooled from max. practicable temperature and tempered at 150°C.; (8) as (7), then aged for 1 000 hr. at 140°C. Changes in extension accompanying these heat treatments are complicated by grain-size effects, but, in general, quenching and tempering at 150°C. cause a severe fall in ductility. With some alloys, ageing at 140°C. causes a further decrease in extension, although strength may be either const. or falling during the same period. Fractures of these alloys are normally transcrystalline, but after the ageing treatment certain compositions give intercrystalline fractures.

2226 539.501

Rheological series. ROBERTSON, R. H. S., AND HATHAWAY, H. W. J. *Nature, Lond.*, 151, *p.* 728, *June* 26, 1943.

2227 539.501 : 532.137

The penetrometer method for determining the flow properties of high-viscosity fluids. PENDLETON, W. W. *J. Appl. Phys.*, 14, *pp.* 170–180, *April*, 1943.—The theory of the penetrometer has been developed to a point where abs. viscosities may be determined both for viscous flow independent and dependent on rate of shear. The method was checked, (1) with the capillary viscometer using coal tar pitch and (2) with the revised axially-moving-cylinder method using a high-melting blown asphalt. Earlier formulae for std. instruments based on viscous flow are invalid when applied to fluids showing generally viscous flow properties. The power-function law rel. shearing stress and rate of shear holds for the asphalt studied over the range of rate of shear from 10^{-5} to 10 sec.$^{-1}$ In addition to speed of operation and precision, the penetrometer has the advantage of minimizing the elastic effects and reproducibility without extensive heat treatment and preworking. Entire shearing-stress/rate-of-shear curves can be determined with 1 load and 1 penetration, using a succession of time intervals. H. H. HO.

2228 539.501 : 677.46

Flow and recovery properties of viscose rayon yarn. PRESS, J. J. *J. Appl. Phys.*, 14, *pp.* 224–233, *May*, 1943.—A series of flow and recovery tests are used as a basis for describing and interpreting the elastic, viscous and tensile properties of a typical solid linear high polymer. Extensions of viscose rayon at 70°F. and 65% R.H. are given under loads of 0·1 to 1·0 g./denier (1 900 to 19 000 lb./in.^{2}) for times up to 10^6 sec. Recoveries at 70°F. are given for times up to 10^6 sec. at 65% R.H. and also after wetting and reconditioning to remove internal strains. The data are interpreted in terms of changes in modulus, vis-

cosity, restoring forces, viscous flow, crystallization and internal load distribution.

2229 539.53 : 620.178.1

The hardness testing of metals and alloys. Donaldson, J. W. *Metallurgia, Manchr, pp.* 3–9, *May*, 1943.—[Abstr. 1812 B (1943)].

PHYSICAL CHEMISTRY

2230 54 : 621.385.833

Electron microscopy in chemistry. Zworykin, V. K. *Industr. Engng Chem.*, 35, *pp.* 450–458, *April*, 1943.—[Abstr. 1909 B (1943)].

2231 541.123

Ternary liquid and binary vapour-liquid systems. Dryden, C. E. *Industr. Engng Chem.*, 35, *pp.* 492–494, *April*, 1943.—A method of correlating equilibrium distribution relations of the solute betw. conjugate phases on a solvent-free basis in liquid-liquid systems and its application to the graphical solution of the Maloney–Schubert diagram for theoretical extraction stages is presented, together with the analogous vapour-liquid equilibrium method.

2232 541.123.2

Quantitative investigations of amino acids and peptides. XIII. Equilibria between histidine and formaldehyde. XIV. Equilibria between amino acids and formaldehyde: arginine and lysine. Frieden, E. H., Dunn, M. S., and Coryell, C. D. *J. Phys. Chem.*, 47, *pp.* 85–94 *and* 118–133, *Feb.*, 1943.—The polarimetric method was applied. Each of the three ionic forms of histidine reacts with first one, and then another mole of formaldehyde. The calculation of the values of 5 equilibrium const. which characterize these reactions is described. The reaction of arginine and formaldehyde is an instantaneous, probably reversible combination of 1 mole of each of the reactants, followed by a slow irreversible combination of the product with another formaldehyde molecule. The latter reaction apparently involves the guanidino group of the amino acid.

2233 541.123.3

Effect of temperature on liquid-liquid equilibrium. Briggs, S. W., and Comings, E. W. *Industr. Engng Chem.*, 35, *pp.* 411–417, *April*, 1943.—With ref. to the application of solvent extraction to industrial separations, detailed phase-equilibrium data are tabulated, plotted and discussed for the systems C_6H_6–$(CH_3)_2CO$–H_2O and docosane–1,6-diphenyl-hexane–furfural over a range of temp. Saturation temperatures for solutions of known composition and refr. index data were measured. Temp. variation affects the two systems differently. N. M. B.

2234 541.123.4

The liquid-liquid phase equilibria of the system cyclohexane-methyl-alcohol in the presence of various salts as third components. Eckfeldt, E. L., and Lucasse, W. W. *J. Phys. Chem.*, 47, *pp.* 164–183, *Feb.*, 1943.—A new value for the critical solution temp. (45·14°C.) of the system was obtained. The system was studied with 5 different salts present in the methyl alcohol, each salt being varied through 4 different conc. Liquid-liquid curves for the system saturated with resp. to a third component were obtained for $NaCl_3$ and NaNO.

See Abstr. 2257 541.123.4 : 541.182.63

2235 541.124 : 541.128

Principles of reactor design. Hurt, D. M. *Industr. Engng Chem.*, 35, *pp.* 522–528, *May*, 1943.—A method of correlating the performance of small-scale with large-scale reactors for gas/solid interface reactions is developed. Overall reaction rate is a function of surface reaction rate and diffusional, or mass-transfer, rate. New data on gas-film ht. of reaction values, covering particle sizes and shapes normally used as catalysts, are presented. Data for the oxidation of SO_2 on Pt catalysts are given.

See Abstr. 2249 541.124.7 : 541.134

See Abstr. 2251 541.124.7 : 541.134.2

2236 541.126

The thermal hydrogen-oxygen reaction; measurements in large vessels. Oldenberg, O., and Morris, J. E. *J. Chem. Phys.*, 11, *p.* 247, *May*, 1943.—[See Abstr. 3113 (1942)].

2237 541.127

Kinetics of some exchange reactions of the type $RI + I^{*-} \rightleftarrows RI^{*} + I^{-}$ in alcoholic solution. McKay, H. A. C. *J. Amer. Chem. Soc.*, 65, *pp.* 702–706, *April*, 1943.—A technique is worked out for the study of the kinetics of the exchange reactions between alkyl iodides and iodide ions in alcoholic solution, using I^{128} as an indicator. A new method of obtaining I^{128} in conc. form, and sp. measuring apparatus, were required. The dependence of the bimolecular vel. const. on the conc. of the reactants was determined for ethyl iodide at 30°. The vel. const. and their temp. coeff. were determined for a series of alkyl iodides.

2238 541.127

Industrial reaction rates. *Industr. Engng Chem.*, 35, *pp.* 504–580, *May*, 1943.—A symposium of papers, with the following titles: Prediction of reaction rates, Daniels, F. [Abstr. 2239 (1943)]; Organic reactions, Eyring, H., Hulburt, H. M., and Harman, R. A. [Abstr. 2240 (1943)]; Principles of reactor design. Hurt, D. M. [Abstr. 2235 (1943)]; Solid catalysts and reaction rates. Principles, Hougen, O. A., and Watson, K. M.; Oxidation of sulphur dioxide, Uyehara, O. A., and Watson, K. M. [Abstr. 2242 (1943)]; Cation-exchange water-softening rates, Domaine, J. du, Swain, R. L., and Hougen, O. A. [Abstr. 2273 (1943)]; Catalytic hydrogenation rates: Equipment and control, Anderson, N. K., and Rowe, C. A.; Interpretation of results, Beckmann, R. B., Pufahl, A. E., and Hougen, O. A. [Abstr. 2243 (1943)]; Conduction, convection and heat release in catalytic converters, Wilhelm, R. H., Johnson, W. C., and Acton, F. S. [Abstr. 2183 (1943)]; Vapour-phase esterification rates, Hoerig, H. F., Hanson, D., and Kowalke, O. L. [Abstr. 2241 (1943)].

2239 541.127.1

Prediction of reaction rates. Daniels, F. *Industr. Engng Chem.*, 35, *pp.* 504–510, *May*, 1943.—Examination of 30 unimolecular gas-phase reactions shows that the equation $k = ae^{-Q/RT}$ is applicable. 60% of these reactions have frequency factors, a, of 10^{12} to 10^{14} corresp. to RT/Nh. Larger frequency factors suggest chain reactions and smaller values often indi-

cate an appreciable entropy of activation. Empirical and theoretical rules for predicting reaction rates are examined and illustrated. In checking these rules it is important to look for "hidden" constants and to avoid disturbing factors such as trace catalysts, dissolved air, moisture, light and wall effects.

2240 541.127.1

Organic reactions. EYRING, H., HULBURT, H. M., AND HARMAN, R. A. *Industr. Engng Chem.*, 35, *pp.* 511–521, *May*, 1943.—The rate of a chemical reaction is calculated from the fundamental physical properties of the molecules. The nature of the approximations involved in the usual application of this formula is discussed critically. Evidence is presented for the predominance of polar or ionic binding over homopolar binding in the activated state. Ionic activated states account for catalysed *cis-trans* isomerization and polymerization of substituted olefins by the "singlet" mechanism, addition to double bonds, intramolecular rearrangements, alkylation catalysis by $AlCl_3$ and by acids, as well as surface catalysis. Dehydration and dehydrogenation on metal oxide surfaces are consistent with an ionic activated complex on the surface.

2241 541.127.1

Vapour-phase esterification rates. HOERIG, H. F., HANSON, D., AND KOWALKE, O. L. *Industr. Engng Chem.*, 35, *pp.* 575–580, *May*, 1943.—The esterification rate of acetic acid with ethyl alcohol in the vapour phase was investigated in a flow system using a silica-gel catalyst. The rate of vapour-phase esterification is controlled by the rate of mass transfer or diffusion through a condensed phase present in the capillaries of the silica gel.

2242 541.127.1 : 541.128.1

Solid catalysts and reaction rates. Principles. HOUGEN, O. A., AND WATSON, K. M. **Oxidation of sulphur dioxide.** UYEHARA, O. A., AND WATSON, K. M. *Industr. Engng Chem.*, 35, *pp.* 529–545, *May*, 1943.—Based on the theory of activated adsorption, general rate equations are developed for reactions catalysed by solids. Quantitative expressions are proposed for the effects of adsorption, catalyst activity, particle size, porosity, flow conditions, poisons and diluents as well as temperature, pressure and concentration. A method is outlined for integration of rate equations in the design of commercial reactors. The data of Lewis and Ries on the oxidation of SO_2 in a flow system over a platinized asbestos catalyst are analysed. The data are repr. by an equation based on the assumption that the rate-controlling step is a surface reaction betw. activation-adsorbed SO_2 and atomic O.

2243 541.127.1 : 541.128.1 : 621.316.71.077.6

Catalytic hydrogenation rates. Equipment. ANDERSON, N. K., AND ROWE, C. A. **Interpretation of results.** BECKMANN, R. B., PUFAHL, A. E., AND HOUGEN, O. A. *Industr. Engng Chem.*, 35, *pp.* 554–562, *May*, 1943.—Equipment was constructed for measuring reaction rates in catalytic vapour-phase reactions at h.p. and temp. in continuous-flow systems. Special features are dual-motor-driven needle valves for control of H flow through capillary glass nozzles and for control of pressure on system by release of H. Special electrically heated and cooled preheater and reaction chamber of Duronze metal and closures for rendering reactor leakproof under conditions of severe temperature gradients are shown. Electrical relay circuits for temperature and pressure control in operation of motors are described. Procedures for studying rates of catalytic hydrogenation are outlined, together with precautions in purification of reactants, activation of catalyst, and analysis of product. Reaction-rate equations are developed, incl. the effects of activated adsorption and surface reaction expressed in terms of conc. for 2 catalysts.

See Abstr. 2273 541.127.1 : 663.632.4

See Abstr. 2183 541.128 : 536.2

See Abstr. 2235 541.128 : 541.124

2244 541.128 : 621.892

Catalysis in the oxidation of lubricating oil. LARSEN, R. G., AND ARMFIELD, F. A. *Industr. Engng Chem.*, 35, *pp.* 581–589, *May*, 1943.—The catalytic effect of Fe, Cu and Pb in the bulk and dissolved form on 3 oils broadly representative of those obtainable from Pennsylvania, Mid-continent and California crudes was studied in detail. The variations in catalytic susceptibilities of the oils, as well as in catalytic activities of the metals with conc., are so great that no specified catalyst can be used in laboratory oxidation tests unless correspondence with engines is well established. The catalytic effect of engines on oils was investigated. The oil insolubles (called "crankcase catalysts") which accumulate in engine lubricants are extremely active catalysts. This activity resides in the metallic components, particularly the halides of Fe.

2245 541.128.1

The decomposition of ethylene and carbon monoxide on metallic catalysts. MCKINNEY, A. R. *J. Phys. Chem.*, 47, *pp.* 152–163, *Feb.*, 1943.—Only those metals which form metal carbonyls catalyse the decomposition of CO. The eff. of the metals in the decomposition of ethylene is related to the atomic radius. Catalytic activity is a function of forces residing within the individual atoms and these forces are more or less free to act, dep. on the interrelationship of the catalyst atoms.

See Abstr. 2242 541.128.1 : 541.127.1

2246 541.128.1 : 541.183.03

The catalytic activity of activated nitrogenous carbons. BENTE, P. F., AND WALTON, J. H. *J. Phys. Chem.*, 47, *pp.* 133–148, *Feb.*, 1943.—The catalytic activities of nitrogenous carbons and 1 sugar carbon were compared by measuring their effects on the rates of decomposition of H_2O_2, of oxidation of hydroquinone in various solvents, and of oxidation of alkaline K urate. The optimum temperature was 875°C. The carbons can be arranged in the same order of decreasing activity of all 3 reactions. The carbon prep. from hexamethylenetetramine showed exceptional activity. The decay factor in the decomposition of H_2O_2 is due to adsorption of O on the active centres. Decay on exposure to O was noted for K urate but not for hydroquinone. KCN (0·001 *N*) inhibits all 3 reactions. Photomicrographs of the carbons were prepared and the bulk densities determined. No direct correlation exists betw. the sorptive and the catalytic properties of the carbons.

See Abstr. 2243 541.128.1 : 621.316.71.077.6 : 541.127.1

2247 541.132

Ionization constants of several substituted phenylarsonic acids. PRESSMAN, D., AND BROWN, D. H. *J. Amer. Chem. Soc.*, 65, *pp.* 540–543, *April*, 1943.—In general a given substituent changes the first and second ionization const. by the same factor. In the case of a substituent in the *meta*- and *para*-positions the effect is similar to that for benzoic acid and in the *ortho*-position to that for phenylboric acid.

See Abstr. 2255 541.133.1 : 541.18

2248 541.134 : 536.7 : 532.71

The thermodynamics of aqueous solutions of potassium bromide at 25° from e.m.f. measurements on cells with transference. MACWILLIAM, E. A., AND GORDON, A. R. *J. Amer. Chem. Soc.*, 65, *pp.* 984–985, *May*, 1943.—[See Abstr. 2176 (1942)]. The e.m.f. of the cell with transference Ag, AgBr/KBr(m_1)// KBr(m_2)/AgBr, Ag was measured at 25°, for conc. up to 0·1 *m*. Activity and osmotic coefficients are tabulated.

2249 541.134 : 541.124.7

Activity coefficients of zinc chloride, bromide and iodide from electromotive forces. EGAN, D. M., AND PARTINGTON, J. R. *J. Chem. Soc.*, *pp.* 157–168, *April*, 1943.—The e.m.f.'s of the double cells

$Zn^+|M_2'\text{-}ZnCl_2, Hg_2Cl_2|Hg\text{–}Hg|Hg_2Cl_2, M_2\text{-}ZnCl_2|Zn^-$

$Zn^+|M_2'\text{-}ZnBr_2, Hg_2Br_2|Hg\text{–}Hg|Hg_2Br_2, M_2\text{-}ZnBr_2|Zn^-$

$Zn^+|M_2'\text{-}ZnI_2, Hg_2I_2|Hg\text{–}Hg|Hg_2I_2, M_2\text{-}ZnI_2|Zn^-$,

were measured at 25° and 35° over a range of molarity 0·5–0·001 for $ZnCl_2$, 0·36–0·001 for $ZnBr_2$ and 0·25–0·002 for ZnI_2. The activity coeff. were calculated by using graphical extrapolation, and by correlating e.m.f.'s with the La Mer equation. The chloride and bromide behave as typical strong electrolytes in the conc. range studied, but with the iodide there is evidence of the formation of complex ions.

2250 541.134 : 621.357

Studies on overvoltage. XV. A study of decomposition potentials. Cathodic and anodic polarization of a platinized platinum cathode near the reversible value in hydrogen-saturated acid solutions. FERGUSON, A. L., AND TOWNS, M. B. *Trans. Electrochem. Soc.*, 83, *Prepr. No.* 8, [12 *pp.*], 1943.—The results support the proposition that the electrode phenomena below, at, and above the so-called reversible value are all the same; and that the potential of the electrode under any of these conditions is determined by the activity of H atoms and H ions at the electrode/solution interface and could be calculated by the regular Nernst equation provided these activities were known.

2251 541.134.2 : 541.124.7

The activity coefficients of thallous chloride in ethylene-glycol–water solutions determined by e.m.f. and solubility data at 25°. BLACK, O. D., AND GARRETT, A. B. *J. Amer. Chem. Soc.*, 65, *pp.* 862–865, *May*, 1943.—The cell Tl-Hg/TlCl/AgCl/Ag was studied in water, 20, 40, 60 and 80% ethylene-glycol–water solutions and in ethylene glycol. The solubility of TlCl was studied in 20, 40, 60 and 80% ethylene-glycol–water KCl solutions and in ethylene-glycol KCl solutions. Activity coefficients, solubility product const. and ionization const. were calculated from the e.m.f. and the solubility data.

2252 541.135.5

Deviations between observed and calculated polarographic diffusion currents. MACNEVIN, W. M., AND BALIS, E. W. *J. Amer. Chem. Soc.*, 65, *pp.* 660–664, *April*, 1943.—Experimental deviations from the Ilkovic equation [Abstr. 2623 (1939)] have been checked in nitrate solutions. The possibility that irregular drop formation might account for the deviations was eliminated. In the cases observed, a spherical drop was formed which grew in mass at a uniform rate and broke away cleanly at the tip of the capillary. The deviations from the Ilkovic equation are the result of the properties of the ions and of stirring effects produced by the dropping electrode.

2253 541.135.6

Polarographic characteristics of stannous and cupric tartrate complexes and amperometric titration of tin with cupric ion in tartrate medium. LINGANE, J. J. *J. Amer. Chem. Soc.*, 65, *pp.* 866–872, *May*, 1943.—Polarograms of the stannous tartrate complex in tartrate media comprise cathodic and anodic waves of equal height; the cathodic wave corresponds to reduction to the metallic state and the anodic wave results from oxidation of the stannous complex to the stannic state. Both diffusion currents are $\propto$ conc. of the stannous complex. In acidic tartrate media, a min. occurs in the anodic diffusion current when the conc. of Sn $> 0{\cdot}002\ M$, and with conc. $> 0{\cdot}01\ M$ the anodic wave disappears. The cathodic ½-wave potential is independent of the conc. of the stannous complex, but in acidic tartrate media the anodic ½-wave potential shifts to a more pos. value with increasing conc. The cathodic and anodic reactions are irreversible at the dropping electrode. In acidic tartrate medium the cupric tartrate complex produces a well-defined cathodic wave, but in alkaline tartrate solutions the wave is shifted to such a neg. potential that it is masked by the discharge of Na ion from the supporting electrolyte. A small pre-wave was observed in alkaline tartrate medium. H. H. HO.

See Abstr. 2259 541.138.3 : 541.571.4

2254 541.143 : 535.37 : 535.347

The orientation of molecules produced photochemically in rigid solvents. LEWIS, G. N., AND BIGELEISEN, J. *J. Amer. Chem. Soc.*, 65, *pp.* 520–526, *April*, 1943.—The permanent dichroism [Abstr. 2182 (1942)] has been studied further to ascertain the optical axes of the irradiated molecules and their photochemical products. In all conjugated molecules that have considerable extension in the direction of electronic oscillations, such as the substituted benzidines and their pos. ions, there is normal orientation, and the substance produced shows a max. of absorption with light whose direction of polarization is $\parallel$ that of the exciting light. In other cases (Wurster's blue) the max. absorption is found when the directions of polarization of exciting and measuring light are $\perp$ —abnormal orientation. Diphenylamine and methyldiphenylamine, although so similar in structure, show

different orientation effects, being abnormal in the former, normal in the latter. The cyanides of several dyes of the type of malachite green gave normal orientation. The max. orientation obtainable in the several cases is calculated and compared with the obs. values. H. H. HO.

See Abstr. 2158 541.18 : 532.71

2255 541.18 : 541.133.1

Studies on high-molecular-weight aliphatic amines and their salts. XI. Transference numbers of some primary amine hydrochlorides in aqueous solution and their significance in the interpretation of the micelle theory. HOERR, C. W., AND RALSTON, A. W. *J. Amer. Chem. Soc.*, 65, *pp.* 976–983, *May*, 1943.—[See Abstr. 2923 (1942)].

2256 541.18.046

Effects of inorganic electrolytes on the liberation of —SH in proteins. BURK, N. F. *J. Phys. Chem.*, 47, *pp.* 104–118, *Feb.*, 1943.

2257 541.182.63 : 541.123.4

Studies on ageing and coprecipitation. XXXVII. The distribution coefficient of arsenate between magnesium ammonium phosphate and solution. KOLTHOFF, I. M., AND CARR, C. W. *J. Phys. Chem.*, 47, *pp.* 148–152, *Feb.*, 1943.—[See Abstr. 3133 (1942)].

See Abstr. 2246 541.183.03 : 541.128.1

2258 541.57

Donor-acceptor bonding. I. Etherates of boron trifluoride. II. An electron-diffraction investigation of the structure of dimethyl ether–boron trifluoride. LAUBENGAYER, A. W., FINLAY, G. R., AND BAUER, S. H. *J. Amer. Chem. Soc.*, 65, *pp.* 884–895, *May*, 1943.—MeEtO : BF_3 was prepared, and its properties compared with those of $Me_2O : BF_3$ and $Et_2O : BF_3$. A decrease in molar vol. is observed when donor-acceptor bonds are formed, and the effect of this decrease upon the constitutive properties is discussed. Saturation v.p. measurements on the 3 etherates were made, and v.d. determinations on $Me_2O : BF_3$ led to a value of 13 k.cal. for its heat of dissociation. The calorimetrically determined values for the heats of formation of $Me_2O : BF_3$ and $Et_2O : BF_3$ are 13·9 and 12·5 k.cal., respectively. The heats of solution of boron trifluoride in water and diethyl ether were also determined. Cryoscopic measurements in benzene indicate that the etherates are monomeric. Dipole-moment measurements indicate that the contribution of the donor-acceptor bond to the total dipole moment is small.—An electron-diffraction investigation of $[(CH_3)_2O : BF_3]$ is described which led to the structural data: the boron valence angles are tetrahedral; the dimethyl-ether part of the molecule remains essentially unaffected. It is suggested that the bond formed in the association process is due to an electron pair rather than to dipole-dipole interaction. H. H. HO.

2259 541.571.4 : 541.138.3

The addition of hydrogen to multiple carbon-carbon bonds. IV. The electrolytic reduction of alkyl and aryl acetylenes. CAMPBELL, K. N., AND YOUNG, E. E. *J. Amer. Chem. Soc.*, 65, *pp.* 965–967, *May*, 1943.—Alkyl and aryl acetylenes can be reduced at a spongy Ni cathode in acid solution. 5-decyne, 4-octyne and diphenyl-acetylene yield the *cis*-olefins, phenylacetylene gives a mixture of ethylbenzene and styrene and 1-heptyne yields 1-heptene. No reduction occurs at cathodes of Cd, Pb, amalgamated Pb or Pt; very little reduction occurs at a Cu cathode.

See Abstr. 2191 541.66 : 535.338.42 : 536.7

2260 541.67 : 678.77 : 621.315.616.7

Synthetic flexible insulations. ROSS, A. M. *Gen. Elect. Rev.*, 46, *pp.* 213–218, *April*, 1943.—[Abstr. 1840 B (1943)].

See Abstr. 2161 542.7 : 533.17.08

2261 542.8

Dual alternating-current titrometer. PENTHER, C. J., AND ROLFSON, F. B. *Industr. Engng Chem. (Analyt. Edit.)*, 15, *pp.* 337–340, *May* 15, 1943.—An instrument is described which comprises 2 complete titration stands and an a.c.-operated electrometer which allows the use of any electrode system in aq. or non-aq. solutions. Meter scales and potentiometer circuits are provided which give the instrument a range of $-1{\cdot}65$ to $+1{\cdot}65$ V, readable to 0·5 mV, and with a calomel-glass electrode system, a full *p*H range readable to 0·02 *p*H unit.

CRYSTALLOGRAPHY

See Abstr. 2259 548.138.3 : 541.571.4

See Abstr. 2223 548.55 : 539.378.3

See Abstr. 2197 548.73 : 535.3 : 537.531

See Abstr. 2200 548.73 : 591.111.2 : 537.531

GEOPHYSICS

See Abstr. 2114 550 : 521.036

See Abstr. 2212 550.422 : 539.16

2262 551.465

Boundaries of the Humboldt current. MEARS, E. G. *J. Wash. Acad. Sci.*, 33, *pp.* 125–130, *May* 15, 1943.

2263 551.5 : 533.6 : 797.5

Soaring flight. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 115–133, *April*, 1943.—A discussion held on December 16, 1942.

2264 551.506.3 : 551.524.3(42)

Cold winters at Kew Observatory, 1783–1942. DRUMMOND, A. J. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 147–155, *April*, 1943.

2265 551.515.2 : 621.396.91 : 621.396.821

Atmospherics during the monsoon period. RAO, N. S. S. *Proc. Indian Acad. Sci. A*, 17, *pp.* 83–105, *March*, 1943.—[Abstr. 1938 B (1943)].

See Abstr. 2264 551.524.3 : 551.506.3(42)

2266 551.524.36/.37(41)

The seasonal distribution over the British Isles of the number of days with a screen minimum temperature of 32°F. or below. LEWIS, L. F. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 155–160, *April*, 1943.

2267 551.554

The winds over New England in relation to topography. EUSTIS, R. S., JR. *Bull. Amer. Met. Soc.*, 23, *pp.* 383–387, *Dec.*, 1942.—Speeds by pilot balloons and by kites are deficient above 3 km. and even above 1 km. in the strongest winds. The ratios of mountain-top to free-air velocities in summer are approx. 1·2 at 1 km. and 1·35 at 2 km.; and in winter, 1·5 and 1·75, resp. Extreme velocities are estimated

as the observed balloon values of 40 m./s. at ½ km., 50 m./s., slightly > by balloon, at 1 km., and 62, 74 and 88 m./s. up to double the greatest observed balloon value, at 1½, 2 and 2½ km.

2268 551.577.2(73)

Some recent precipitation maps of the United States. VISHER, S. S. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 135–141, *April*, 1943.

2269 551.577.37(41)

Notable falls of rain in Great Britain. GLASSPOOLE, J. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 133–134, *April*, 1943.—[See Abstr. 499 (1943)].

2270 551.594.221

Lightning striking frequencies for various heights. *Proc. Inst. Radio Engrs, N.Y.*, 31, *p.* 79, *Feb.*, 1943.—Records are given of the numbers of lightning flashes to several structures varying between 80 and 1 250 ft. in height. The rel. betw. the number of flashes and the height of the structure is discussed and figures are deduced for the likelihood of flashes to tall objects.

R. H. G.

VARIOUS SUBJECTS

See Abstr. 2220 591.111.1 : 539.26

See Abstr. 2200 591.111.2 : 548.73 : 537.531

2271 591.182

Electron-microscopic examination of tissues. SJÖSTRAND, F. *Nature, Lond.*, 151, *pp.* 725–726, *June* 26, 1943.

2272 612.11

Normal variation in the concentration of fibrinogen, albumin, and globulin in blood plasma. HILL, R. M., AND TREVORROW, V. *J. Phys. Chem.*, 46, *pp.* 1117–1129, *Dec.*, 1942.—566 analyses of plasma albumin, globulin and fibrinogen have been made on 547 persons from birth to 39 years of age. The changes with age are defined. The plasma albumin conc. in persons over 3 years of age is higher in the winter than in the summer months. No seasonal variations appear in the other fractions. The albumin, globulin and fibrinogen conc. vary independently.

2273 663.632.4 : 541.127.1

Cation-exchange water-softening rates. DOMAINE, J. DU, SWAIN, R. L., AND HOUGEN, O. A. *Industr. Engng Chem.*, 35, *pp.* 546–553, *May*, 1943.—Experiments on the softening of water by cation exchangers and the regeneration of the exchanger by a salt solution were conducted on sufficiently thin beds to permit the differential rate equations to be established in terms of operating variables. Equations and charts are given for the performance of commercial beds of zeolite under conditions of variable thickness, rate of water flow, initial hardness of water and initial base-exchange capacity, particle size and activity of exchanger.

See Abstr. 2160 669.018 : 532.782

See Abstr. 2224 669.144 : 539.4.016.3

See Abstr. 2170 669.18 : 535.33.072

See Abstr. 2225 669.6 : 539.4.016.3

See Abstr. 2218 674.04 : 539.211

See Abstr. 2221 674.049 : 539.32

See Abstr. 2228 677.46 : 539.501

See Abstr. 2222 679.5 : 539.32

2274 77 : 621.327.3

Photographic properties of mercury vapour electric discharge lamps. BOURNE, H. K. *Photogr. J.*, 83, *pp.* 135–142, *April*, 1943.—[Abstr. 1872 B (1943)].

2275 771.54

An improved procedure for the contact-printing method of measuring photographic density. SWEET, M. H. *J. Opt. Soc. Amer.*, 33, *pp.* 143–163, *March*, 1943.—A simplified procedure for obtaining precise measurements conforming with a sp. criterion for evaluating photographic density is described. A variety of commercially available materials can be used without influencing the accuracy. Sources of error are investigated, and a technique for obtaining an independent check. An explicit definition of photographic printing density is proposed. A. H.

2276 771.54

The dependence of intrinsic sensitivity on grain size. SILBERSTEIN, L. *J. Opt. Soc. Amer.*, 33, *pp.* 175–178, *March*, 1943.—Graphical examination of earlier results suggested a connection betw. intrinsic sensitivity (ε) and average grain size ($\bar{a}$). The problem is examined mathematically and the solution obtained indicates the pronounced steady decrease of ε with increasing $\bar{a}$ observed in practice. A. H.

2277 772

Detection of an intermediate step in the autoxidation of hydroquinone. Aerial fogging of photographic emulsions. JAMES, T. H. *J. Chem. Phys.*, 11, *pp.* 183–187, *April*, 1943.—Alkaline hydroquinone solutions, oxidized in the presence of a suitable photographic material, exert a fogging action due to some transitory intermediate in the oxidation process. HO_2 is the fogging agent. The action of different developing agents is explained on the common basis of this intermediate.

2278 778.1

Document-copying camera. *J. Sci. Instrum.*, 20, *pp.* 78–80, *May*, 1943.

2279 778.3

Photography as a scientific instrument. *Nature, Lond.*, 151, *pp.* 718–721, *June* 26, 1943.—A report of the first meeting of the Association for Scientific Photography. Miscellaneous applications are described and a series of papers is summarized, dealing with mass radiography for tuberculosis, industrial radiography, photomicrography and the photography of photo-elastic stress patterns. J. T.

See Abstr. 2104 778.3 : 515.6

See Abstr. 2145 778.5 : 531.765

See Abstr. 2164 788.5 : 534.321

See Abstr. 2263 797.5 : 533.6 : 551.5